Offshore Windparks – Planning, Construction and Future Developments

Dipl.-Ing. Kerstin Wessel, Vattenfall Europe Windkraft GmbH, Hamburg

2011.08.23 – INFORSE-Europe Sustainable Energy Seminar 2011
Security class: Open/public information
## Table of Content

- Introduction Vattenfall
- Offshore Windparks at Vattenfall: Achievements and Plans
- Planning Process Offshore Windparks
- Construction Process Offshore Windparks
- Future Developments in Offshore Wind Energy
Vattenfall at a glance (1)

Overall:

• Europe’s fifth largest generator of electricity and the largest producer of heat

• Operations in Sweden, Finland, Denmark, Germany, Poland, the Netherlands, Belgium and the UK

• Core markets: Sweden, Germany and the Netherlands

• 40,000 employees total

• Vattenfall AB is wholly owned by the Swedish state
Wind Energy:
• Vattenfall Wind Power operates abt. 900 WTG onshore and offshore with installed rated power of:
  - abt. 600 MW onshore
  - abt. 690 MW offshore

• Annual production from wind energy by Vattenfall abt. 3.8 TWh → electricity for abt. 1 million households

• With a total of eight offshore wind farms in five countries Vattenfall is the second largest offshore wind farm operator in the world.


• Employees at Vattenfall Wind Power: 262, of which 35 in Germany (Status 05/2011)
Vattenfall Offshore Wind Power
Marketshare 2009-2010

Source: Emerging Energy Technology December 2009
## Vattenfall AB: Offshore Wind Portfolio

### Denmark (160 MW)
- **Horns Rev I (160 MW)**
  - In operation since 2002

### Netherlands (400 MW)
- **Egmond aan Zee (108 MW)**
  - In operation since 2007
- **Beaufort (340 MW)**
  - Development

### United Kingdom (> 7 GW)
- **Kentish Flats (90 MW)**
  - In operation since 2005
- **Thanet (300 MW)**
  - In operation since 2010
- **Ormonde (150 MW)**
  - Commissioning 2011
- **East Anglia (7.2 GW)**
  - Development

### Sweden (~1 GW)
- **Utgrunden (10 MW)**
  - In operation since 2000
- **Yttre Stengrund (10 MW)**
  - In operation since 2001
- **Lillgrund (110 MW)**
  - In operation since 2007
- **Kriegers Flak (640 MW)**
  - Development
- **Taggen (300 MW)**
  - Development
- **Trolleboda (110-150 MW)**
  - Development

### Germany (~750 MW)
- **alpha ventus (60 MW)**
  - In operation since 2010
- **DanTysk (288 MW)**
  - Construction 2012/2013
- **Nordpassage (400 MW)**
  - Development
 THANET – largest Offshore Windpark of the World

- Total capacity: 300 MW (100 Vestas V90 with 3 MW)
- Annual production: 974 GWh/year
- Site: 12km of Forness-Point, Kent

---

**Thanet (UTH) Park Performance Report**

<table>
<thead>
<tr>
<th>Production</th>
<th>Wind Average</th>
<th>Capacity Factor</th>
<th>Time Based</th>
<th>Energy Based</th>
<th>Lost Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>65,510,859 kWh</td>
<td>9.4 m/s</td>
<td>47.89%</td>
<td>96.6%</td>
<td>96.6%</td>
<td>2,276,034 kWh</td>
</tr>
</tbody>
</table>

**Expected Stops:** 0

**Service or Failure Stops:** 25

**Hours On Grid:** ?

**Hours Off Grid:** 1,547.3
ORMONDE – Commissioning 2011

Facts

- Total capacity: 150 MW
- Annual production: 508 GWh/year
- Number of supplied households: around 100,000*
- Number of turbines: 30 REpower turbines à 5 MW
- Commissioning: End 2011
- Site: 10 km off the Coast, in the Irish Sea

Multicontracting:
- **REpower Systems**: 30 x 5MW turbines
- **BiFab**: foundation
- **Areva**: cable

The final and 30th turbine was installed at 1st August 2011.

*by an average consumption of 4.478 kWh/year of British households
DanTysk  Vattenfall’s Offshore-Projekt in the North Sea in Cooperation with Stadtwerke München

- Area: 71 km²
- Water depth: 21-31 m
- Investment: > 1 Mrd. €
- 80 Siemens 3,6 MW (120m Rotor) Turbines
- WEA Installation Vessel: Pacific Osprey - Swire Blue Ocean
- Jacket/Topside-Substation by Strukton/Hollandia
- Construction: End 2012 – 2013
- Commissioning: 2014
- Joint Venture with Stadtwerke München (SWM have share of 49%)
Offshore-News: Vattenfall setzt für DanTysk auf riesiges Installationsschiff

UK Round 3: Norfolk Bank Zone/ East Anglia Array

<table>
<thead>
<tr>
<th><strong>East Anglia Array/ Norfolk Bank Zone</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total capacity</strong></td>
</tr>
<tr>
<td><strong>UK Round III</strong></td>
</tr>
<tr>
<td><strong>Site</strong></td>
</tr>
<tr>
<td><strong>Area</strong></td>
</tr>
<tr>
<td><strong>Begin construction</strong></td>
</tr>
</tbody>
</table>
Planning Process Offshore Windparks (e.g.)

- **Site investigation** and monitoring: soil / wind / wave / current / environmental / bombs / wrecks / archeolog.
- **Permit** for construction and operation
- Onshore **grid connection** (in Germany: including export cable)
- **Contracts** for supply of components (WTG, foundation, array cables, substation(s), accommodation platform, export cable)
- Ensuring sufficient **capacities** of:
  - Installation vessels
  - Manufacturing sites
  - Port facilities / Storage facilities
- **Final investment** decision (FID)
- Development of optimal **construction schedule**
- **Design** of all components including interfaces
- **Planning** of construction management, quality control as well as HSSE procedures (Health, Safety, Security and Environment)
Construction Process Offshore Windparks

- Components to be installed:

  - **Foundation WTG**
    - Monopile
    - Transition piece
    - Grouting
    - Jacket
    - Piles
    - Grouting
    - Tripod
    - Piles
    - Grouting
  
  - **Cables**
    - Inner Array
    - Export Cables
    - Grid Connect.
  
  - **WTG**
    - Tower
    - Nacelle
    - Blades
  
  - **Offshore Substation**
    - Foundation
    - Topside
  
  - **Accommodation Platform**
    - Foundation
    - Topside
Offshore Windenergie – Challenge und Chances

Wer den Hafen nicht kennt, in den er segeln will, für den ist kein Wind der richtige.

(Seneca)
Impression: Port Locations (2010 / 2011)
Impressions: Installation Foundation (2011)
Impressions: Tripods (2009)
Impressions: Array Cable Installation (2010)
Impressions: WTG Components (2010)
Impressions: Transport WTG to the Offshore Site (2009)
Impressions: Offshore Substation (2008)
Impression: Offshore Wind Farm with Substation
Future Development Offshore Wind Energy (Politics)

• **Germany***:
  - In 2010 → 16.8 % renewable energy share of electricity consump.
  - Plan 2020 → reduce electricity consumption from currently abt. 600 TWh to 560 TWh → 35 % renewables energy share of electricity consumption
  - Plan 2030 → 10 GW installed capacity offshore wind energy → 6 % share of electricity consumption (one offshore windpark with 400 MW can produce abt. 1,500 GWh electricity)

• **EU – 27**:
  - In 2009 → 18 % renewable energy share in electricity consumption
  - Plan 2020 → 20 % renewable energy share

* source: Background information on development of renewable energy in Germany, Fed. Gov. Germany, May 2011
** source: Study by EURO Observer, 2010
Future Development Offshore Wind Energy (Technology)

- "Industrialization" of installation process
  - Installation vessels with large capacities
  - Suitable ports with sufficient storage capacities
  - Qualified personnel

- Sufficient manufacturing capacities

- Low maintenance and durable components (WTG, equipment)

- Improvements in accessibility of locations in wind farms during operation

- Reduce costs during manufacturing, construction and operation
Offshore Wind Energy

• Offshore wind is and will be an important renewable energy source with significantly increasing share in the future

• Improve efficient reduction in energy consumption

• Conduct further investments in all other renewable energy sources

• Focus on sustainable energy future

➔ Let us join forces!
Thank you!